

This print-out should have 27 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

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**001 10.0 points**

Arrange the compounds

- |                                     |                                |
|-------------------------------------|--------------------------------|
| I) CuS                              | $K_{sp} = 1.3 \times 10^{-36}$ |
| II) PbCl <sub>2</sub>               | $K_{sp} = 1.6 \times 10^{-5}$  |
| III) FeS                            | $K_{sp} = 6.3 \times 10^{-18}$ |
| IV) Hg <sub>2</sub> Cl <sub>2</sub> | $K_{sp} = 2.6 \times 10^{-18}$ |
| V) Cu <sub>2</sub> S                | $K_{sp} = 2.0 \times 10^{-47}$ |

in increasing order of molar solubility.

1. I, V, III, IV, II **correct**

2. I, II, III, IV, V

3. II, III, IV, I, V

4. II, IV, III, V, I

5. V, I, IV, III, II

**Explanation:**

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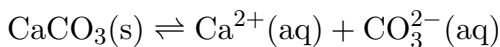
**002 10.0 points**

What is the molar solubility of CaCO<sub>3</sub> in water?  $K_{sp} = 8.7 \times 10^{-9}$ .

Correct answer:  $9.32738 \times 10^{-5}$  mol/L.

**Explanation:**

The solubility equilibrium is



$$K_{sp} = [\text{Ca}^{2+}][\text{CO}_3^{2-}] = S \cdot S$$

$$8.7 \times 10^{-9} = S^2$$

$$S = 9.32738 \times 10^{-5} \text{ mol/L}$$

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**003 10.0 points**

Determine if a precipitate will form when 0.96 g Na<sub>2</sub>CO<sub>3</sub> is combined with 0.2 g BaBr<sub>2</sub> in a 10 L solution ( $\text{BaCO}_3 K_{sp} = 2.8 \times 10^{-9}$ ).

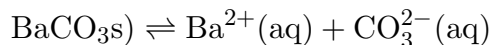
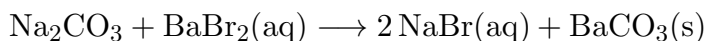
1. NaBr does not precipitate

2. NaBr precipitates **correct**

**Explanation:**

$$V_{\text{Na}_2\text{CO}_3} = 0.96 \text{ g/10 L} \quad V_{\text{BaBr}_2} = 0.2 \text{ g/10 L}$$

$$K_{sp} = 2.8 \times 10^{-9}$$



$$K_{sp} = [\text{Ba}^{2+}][\text{CO}_3^{2-}] = 2.8 \times 10^{-9}$$

$$\left( \frac{0.96 \text{ g Na}_2\text{CO}_3}{10 \text{ L}} \right) \left( \frac{1 \text{ mol CO}_3^{2-}}{105.96 \text{ g Na}_2\text{CO}_3} \right) = 0.001812 \text{ mol/L CO}_3^{2-}$$

$$\left( \frac{0.2 \text{ g BaBr}_2}{10 \text{ L}} \right) \left( \frac{2 \text{ mol Br}^-}{297.13 \text{ g BaBr}_2} \right) = 0.000134621 \text{ mol/L Br}^-$$

$$[\text{Ba}^{2+}][\text{CO}_3^{2-}] = (0.001812 \text{ mol/L}) \times (0.000134621 \text{ mol/L}) = 2.43934 \times 10^{-7} > K_{sp}$$

BaCO<sub>3</sub> precipitates.

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**004 10.0 points**

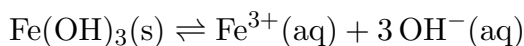
If 2.5 g of solid Fe(NO<sub>3</sub>)<sub>3</sub> is added to 100 mL of a  $1 \times 10^{-20}$  M NaOH solution, will a precipitate form?

1. Fe(NO<sub>3</sub>)<sub>3</sub> precipitates.

2. Fe(NO<sub>3</sub>)<sub>3</sub> does not precipitate. **correct**

**Explanation:**

solubility of Fe(NO<sub>3</sub>)<sub>3</sub> = 2.5 g/100 mL H<sub>2</sub>O  
 $m_{\text{Fe(NO}_3)_2} = 2.5 \text{ g}$        $[\text{NaOH}] = 1 \times 10^{-20} \text{ M}$   
 $K_{sp} = 4 \times 10^{-38}$



$$K_{sp} = [\text{Fe}^{3+}][\text{OH}^-]^3 = 4 \times 10^{-38}$$

$$\left( 2.5 \text{ g Fe(NO}_3)_3 \right) \left( \frac{1 \text{ mol Fe(NO}_3)_3}{241.79 \text{ g Fe(NO}_3)_3} \right) = 1.03396 \times 10^{-2} \text{ mol Fe(NO}_3)_3 = 1.03396 \times 10^{-2} \text{ mol Fe}^{3+}$$

$$\left( \frac{1.03396 \times 10^{-2} \text{ mol Fe}^{3+}}{100 \text{ mL}} \right) \left( \frac{1000 \text{ mL}}{\text{L}} \right) = 1.03396 \times 10^{-1} \text{ mol/L Fe}^{3+}$$

$$[\text{NaOH}] = 1 \times 10^{-20} \text{ M} = [\text{OH}^-]$$

$$\begin{aligned} [\text{Fe}^{3+}] [\text{OH}^-]^3 &= (1.03396 \times 10^{-1} \text{ mol/L}) \\ &\times (1 \times 10^{-20} \text{ M})^3 \\ &= 1.03396 \times 10^{-61} < K_{\text{sp}} \end{aligned}$$

$\text{Fe}(\text{OH})_3$  does not precipitate.

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**005 10.0 points**

The  $K_{\text{sp}}$  for mercury(I) iodide is  $1.2 \times 10^{-28}$ . What is the solubility of mercury(I) iodide?

1.  $1.1 \times 10^{-14}$
2.  $5.2 \times 10^{-8}$
3.  $3.1 \times 10^{-10}$  **correct**
4.  $3.9 \times 10^{-10}$

**Explanation:**

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**006 10.0 points**

A solution has  $[\text{CO}_3^{2-}] = 2 \times 10^{-6}$  and  $[\text{Co}^{2+}] = 1 \times 10^{-5}$ . Will a precipitate of  $\text{CoCO}_3$  form?  $K_{\text{sp}}$  for  $\text{CoCO}_3 = 8 \times 10^{-13}$ .

1. Yes, because  $Q$  is greater than  $K_{\text{sp}}$ . **correct**
2. No, because  $Q$  is greater than  $K_{\text{sp}}$ .
3. No, because  $K_{\text{sp}}$  is greater than  $Q$ .
4. Yes, because  $K_{\text{sp}}$  is greater than  $Q$ .

**Explanation:**

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**007 10.0 points**

$K_{\text{sp}}$  for  $\text{ZnS}$  is  $1.1 \times 10^{-21}$ . At what  $\text{S}^{2-}$  concentration will  $\text{ZnS}$  precipitate for a 0.20 M solution of  $\text{Zn}(\text{NO}_3)_2$ ?  $\text{Zn}(\text{NO}_3)_2$  is a very soluble salt.

1.  $2.4 \times 10^{-10} \text{ M}$

2.  $3.3 \times 10^{-11} \text{ M}$

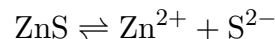
3.  $2.2 \times 10^{-20} \text{ M}$

4.  $5.5 \times 10^{-20} \text{ M}$

5.  $5.5 \times 10^{-21} \text{ M}$  **correct**

**Explanation:**

$$K_{\text{sp}} \text{ for } \text{ZnS} = 1.1 \times 10^{-21}$$



$$K_{\text{sp}} = [\text{Zn}^{2+}] [\text{S}^{2-}]$$

Since  $\text{Zn}(\text{NO}_3)_2$  is very soluble, there will be an extra 0.20 M  $\text{Zn}^{2+}$  in solution.

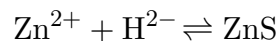
$$1.1 \times 10^{-21} = (x + 0.20) (x)$$

We can disregard  $x$  in  $x + 0.20$  because the  $K_{\text{sp}}$  is very small, which means  $\text{ZnS}$  doesn't dissociate much. So the equation now becomes

$$\begin{aligned} 1.1 \times 10^{-21} &= (0.20) (x) \\ x &= 5.5 \times 10^{-21} \text{ M} \end{aligned}$$

**Alternate Solution:**

$$K_{\text{sp}} \text{ ZnS} = [\text{Zn}^{2+}] [\text{S}^{2-}] = 1.1 \times 10^{-21}$$



Initial	0.2	—	—
Change	$x$	$x$	—
Final	$0.2 + x$	$x$	—

$$K_{\text{sp}} = (0.2 + x) (x) = 1.1 \times 10^{-21}$$

$x$  will be very small compared to 0.2, so  $0.2 + x \approx 0.2$ , and

$$\begin{aligned} K_{\text{sp}} &= 0.2 x = 1.1 \times 10^{-21} \\ x &= \frac{1.1 \times 10^{-21}}{0.2} = 5.5 \times 10^{-21} \end{aligned}$$

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**008 (part 1 of 2) 10.0 points**

Find the  $Q_{\text{sp}}$  when 5 mL of 0.19 M  $\text{K}_2\text{CO}_3(\text{aq})$

and 1 L of 0.019 M  $\text{AgNO}_3(\text{aq})$  are mixed together. The solubility product of  $\text{Ag}_2\text{CO}_3$  is  $6.2 \times 10^{-12}$ .

Correct answer:  $3.37857 \times 10^{-7}$ .

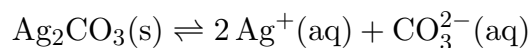
**Explanation:**

$$\begin{aligned} V_{\text{K}_2\text{CO}_3} &= 5 \text{ mL} = 0.005 \text{ L} & m_{\text{K}_2\text{CO}_3} &= 0.19 \text{ M} \\ V_{\text{AgNO}_3} &= 1 \text{ L} & m_{\text{AgNO}_3} &= 0.019 \text{ M} \\ V_{\text{tot}} &= 0.005 \text{ L} + 1 \text{ L} = 1.005 \text{ L} \end{aligned}$$

$$[\text{Ag}^+] = (0.019 \text{ M}) \cdot \frac{1 \text{ L}}{1.005 \text{ L}} = 0.0189055 \text{ M}$$

$$[\text{CO}_3^{2-}] = (0.19 \text{ M}) \cdot \frac{0.005 \text{ L}}{1.005 \text{ L}} = 0.000945274 \text{ M}$$

The reaction is



$$\begin{aligned} Q_{\text{sp}} &= [\text{Ag}^+]^2[\text{CO}_3^{2-}] \\ &= (0.0189055)^2(0.000945274) \\ &= 3.37857 \times 10^{-7} \end{aligned}$$

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**009 (part 2 of 2) 10.0 points**

Will a precipitate form?

1. Yes **correct**

2. No

**Explanation:**

$$K_{\text{sp}} = 6.2 \times 10^{-12}$$

A precipitate will form because  $Q_{\text{sp}} > K_{\text{sp}}$ .

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**010 10.0 points**

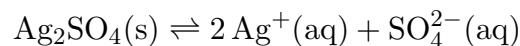
What is the value of  $K_{\text{sp}}$  for  $\text{Ag}_2\text{SO}_4$  if 5.66 g is soluble in 1.00 L of water?

Correct answer:  $2.39381 \times 10^{-5}$ .

**Explanation:**

solubility of  $\text{Ag}_2\text{SO}_4 = 5.66 \text{ g/L H}_2\text{O}$

$$\begin{aligned} \text{solubility} &= \left( \frac{5.66 \text{ g Ag}_2\text{SO}_4}{\text{L}} \right) \\ &\quad \times \left( \frac{\text{mol Ag}_2\text{SO}_4}{311.75 \text{ g Ag}_2\text{SO}_4} \right) \\ &= 0.0181556 \text{ mol/L Ag}_2\text{SO}_4 \end{aligned}$$



$$\begin{aligned} [\text{Ag}^+] &= 2(0.0181556) = 0.0363111 \\ [\text{SO}_4^{2-}] &= 0.0181556 \end{aligned}$$

$$\begin{aligned} K_{\text{sp}} &= [\text{Ag}^+]^2[\text{SO}_4^{2-}] \\ &= (0.0363111)^2(0.0181556) \\ &= 2.39381 \times 10^{-5} \end{aligned}$$

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**011 10.0 points**

The term solubility refers to

1. the ability of a substance to gain electrons in solution.
2. the ability of a substance to react with acids or bases in solution.
3. the ability of a substance to form ions in solution.
4. the ability of a substance to gain or lose protons in solution.
5. the ability of a substance to dissolve in solution. **correct**

**Explanation:**

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**012 10.0 points**

$K_{\text{sp}}$  for iron(III) iodate ( $\text{Fe}(\text{IO}_3)_3$ ) is  $1.0 \times 10^{-14}$ . We mix two solutions, one containing  $\text{Fe}^{3+}$  and one containing  $\text{IO}_3^-$ . At the instant of mixing,  $[\text{Fe}^{3+}] = 10^{-3} \text{ M}$  and  $[\text{IO}_3^-] = 10^{-3} \text{ M}$ . Which of the following statements is true?

1. A precipitate forms because  $Q_{\text{sp}}$  is less than  $K_{\text{sp}}$ .
2. A precipitate forms because  $Q_{\text{sp}}$  is greater than  $K_{\text{sp}}$ . **correct**
3. No precipitate forms because  $Q_{\text{sp}}$  is greater than  $K_{\text{sp}}$ .
4. None of the statements is true.

5. No precipitate forms because  $Q_{\text{sp}}$  is less than  $K_{\text{sp}}$ .

**Explanation:**

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**013 10.0 points**

If equal volumes of 0.004 M  $\text{Pb}(\text{NO}_3)_2(\text{aq})$  and 0.004 M  $\text{KI}(\text{aq})$  are mixed, what reaction, if any, occurs? The value of  $K_{\text{sp}}$  for  $\text{PbI}_2$  is  $1.4 \times 10^{-8}$ .

1.  $\text{KNO}_3(\text{s})$  precipitates.
2. The solution turns purple due to formation of  $\text{I}_2$ .
3. No reaction occurs. **correct**
4.  $K_{\text{sp}}$  changes to  $9 \times 10^{-9}$ .
5.  $\text{PbI}_2(\text{s})$  precipitates.

**Explanation:**

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**014 10.0 points**

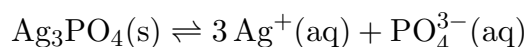
What is  $K_{\text{sp}}$  for  $\text{Ag}_3\text{PO}_4$ , if its molar solubility is  $2.7 \times 10^{-6}$  mol/L?

1.  $1.4 \times 10^{-21}$  **correct**
2.  $7.3 \times 10^{-12}$
3.  $5.3 \times 10^{-16}$
4.  $5.3 \times 10^{-23}$
5.  $4.8 \times 10^{-22}$
6.  $2.0 \times 10^{-17}$
7.  $1.7 \times 10^{-14}$

**Explanation:**

$$S = 2.7 \times 10^{-6} \text{ mol/L}$$

The solubility equilibrium is



$$[\text{Ag}^+] = 3S = 8.1 \times 10^{-6} \text{ mol/L}$$

$$[\text{PO}_4^{3-}] = S = 2.7 \times 10^{-6} \text{ mol/L}$$

$$\begin{aligned} K_{\text{sp}} &= [\text{Ag}^+]^3 [\text{PO}_4^{3-}] \\ &= (8.1 \times 10^{-6})^3 (2.7 \times 10^{-6}) \\ &= 1.43489 \times 10^{-21} \end{aligned}$$

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**015 10.0 points**

Calculate the solubility product constant for calcium carbonate, given that it has a solubility of  $5.3 \times 10^{-5}$  g/L of water.

1.  $1.49 \times 10^{-19}$
2.  $1.06 \times 10^{-13}$
3.  $2.81 \times 10^{-13}$  **correct**
4.  $7.89 \times 10^{-26}$
5.  $3.11 \times 10^{-14}$

**Explanation:**

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**016 10.0 points**

A saturated solution of  $\text{CaF}_2(\text{s})$  is found to have a  $\text{F}^-$  concentration of  $4.9 \times 10^{-4}$  M. What is the value of  $K_{\text{sp}}$  for  $\text{CaF}_2$ ?

1.  $5.88 \times 10^{-17}$
2.  $3.92 \times 10^{-11}$
3.  $5.88 \times 10^{-11}$  **correct**
4.  $7.644 \times 10^{-9}$
5.  $1.176 \times 10^{-8}$

**Explanation:**

$$[\text{F}^-] = 4.9 \times 10^{-4} \text{ M}$$



$$\begin{aligned} K_{\text{sp}} &= \left(\frac{x}{2}\right) (x)^2 = \frac{x^3}{2} \\ &= \frac{(4.9 \times 10^{-4})^3}{2} = 5.88 \times 10^{-11} \end{aligned}$$

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**017 10.0 points**

Consider the following data

Compound	$K_{sp}$
PbCl <sub>2</sub>	$1.7 \times 10^{-5}$
PbBr <sub>2</sub>	$3.3 \times 10^{-6}$
Fe(OH) <sub>2</sub>	$7.9 \times 10^{-15}$
MgF <sub>2</sub>	$6.4 \times 10^{-9}$

Which compound has the greatest molar solubility?

1. PbCl<sub>2</sub> **correct**
2. Cannot tell from the information given.
3. PbBr<sub>2</sub>
4. Fe(OH)<sub>2</sub>
5. MgF<sub>2</sub>

**Explanation:**

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**018 10.0 points**

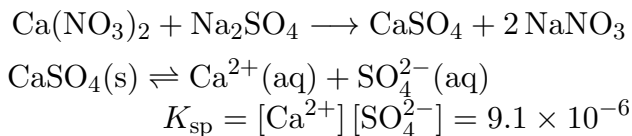
Does a precipitate form if 100 mL of 0.00140 M Ca(NO<sub>3</sub>)<sub>2</sub> and 200 mL of 0.000200 M Na<sub>2</sub>SO<sub>4</sub> are mixed?

1. CaSO<sub>4</sub> does not precipitate. **correct**
2. CaSO<sub>4</sub> precipitates.

**Explanation:**

$$V_{\text{Ca(NO}_3)_2} = 0.1 \text{ L} \quad [\text{Ca(NO}_3)_2] = 0.0014 \text{ M}$$

$$V_{\text{Na}_2\text{SO}_4} = 0.2 \text{ L} \quad [\text{Na}_2\text{SO}_4] = 0.0002 \text{ M}$$



$$(0.1 \text{ L})(0.0014 \text{ M Ca}^{2+}) = 0.00014 \text{ mol}$$

$$(0.2 \text{ L})(0.0002 \text{ M SO}_4^{2-}) = 4 \times 10^{-5} \text{ mol}$$

$$\text{total volume} = 0.1 \text{ L} + 0.2 \text{ L} = 0.3 \text{ L}$$

$$\frac{0.00014 \text{ mol Ca}^{2+}}{0.3 \text{ L}} = 0.000466667 \text{ mol/L}$$

$$\frac{4 \times 10^{-5} \text{ mol SO}_4^{2-}}{0.3 \text{ L}} = 0.000133333 \text{ mol/L}$$

$$[\text{Ca}^{2+}][\text{SO}_4^{2-}] = (0.000466667 \text{ mol/L})$$

$$\times (0.000133333 \text{ mol/L})$$

$$= 6.22222 \times 10^{-8} < K_{sp}$$

CaSO<sub>4</sub> does not precipitate.

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**019 10.0 points**

Determine whether a precipitate will form if 20 mL of  $1 \times 10^{-7}$  M AgNO<sub>3</sub> is mixed with 20 mL of  $2 \times 10^{-9}$  M NaCl at 25°C.

1. AgCl precipitates.
2. AgCl does not precipitate. **correct**

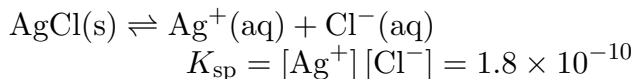
**Explanation:**

$$V_{\text{AgNO}_3} = 0.02 \text{ L}$$

$$[\text{AgNO}_3] = 1 \times 10^{-7} \text{ M}$$

$$V_{\text{NaCl}} = 0.02 \text{ L}$$

$$[\text{NaCl}] = 2 \times 10^{-9} \text{ M}$$



$$(0.02 \text{ L})(1 \times 10^{-7} \text{ M Ag}^+) = 2 \times 10^{-9} \text{ mol}$$

$$(0.02 \text{ L})(2 \times 10^{-9} \text{ M Cl}^-) = 4 \times 10^{-11} \text{ mol}$$

$$\text{total volume} = 0.02 \text{ L} + 0.02 \text{ L} = 0.04 \text{ L}$$

$$\frac{2 \times 10^{-9} \text{ mol Ag}^+}{0.04 \text{ L}} = 5 \times 10^{-8} \text{ mol/L Ag}^+$$

$$\frac{4 \times 10^{-11} \text{ mol Cl}^-}{0.04 \text{ L}} = 1 \times 10^{-9} \text{ mol/L Cl}^-$$

$$[\text{Ag}^+][\text{Cl}^-] = (5 \times 10^{-8} \text{ mol/L})$$

$$\times (1 \times 10^{-9} \text{ mol/L})$$

$$= 5 \times 10^{-17} < K_{sp}$$

AgCl does not precipitate.

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**020 10.0 points**

Pure water is saturated with  $\text{PbCl}_2$ . In this saturated solution

1.  $[\text{Pb}^{2+}] = [\text{Cl}^-]$ .
2.  $[\text{Pb}^{2+}] = 0.5 [\text{Cl}^-]$  . **correct**
3.  $K_{\text{sp}} = [\text{Pb}^{2+}]$ .
4.  $2 [\text{Cl}^-] = [\text{Pb}^{2+}]$ .
5.  $[\text{Pb}^{2+}] [\text{Cl}^-] = K_{\text{sp}}$ .

**Explanation:**

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**021 10.0 points**

If a solution is  $1.0 \times 10^{-5}$  M in  $\text{Mn}(\text{NO}_3)_2$  and  $1.5 \times 10^{-3}$  M in aqueous ammonia, will  $\text{Mn}(\text{OH})_2$  precipitate?

$$K_{\text{b}} \text{ for } \text{NH}_3 = 1.8 \times 10^{-5}$$

$$K_{\text{sp}} \text{ for } \text{Mn}(\text{OH})_2 = 2.0 \times 10^{-13}$$

1. yes, because  $K_{\text{sp}} > Q_{\text{sp}}$ .
2. no, because  $Q_{\text{sp}} > K_{\text{sp}}$ .
3. no, because  $K_{\text{sp}} > Q_{\text{sp}}$ .
4. yes, because  $Q_{\text{sp}} > K_{\text{sp}}$ . **correct**

**Explanation:**

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**022 10.0 points**

Consider the  $K_{\text{sp}}$  values of the following salts and indicate which of these is least soluble in water. You really don't need to use a calculator to solve this problem.

1.  $\text{AB}_4$   $K_{\text{sp}} = 1 \times 10^{-25}$  **correct**
2.  $\text{AB}_3$   $K_{\text{sp}} = 1 \times 10^{-20}$
3.  $\text{AB}_2$   $K_{\text{sp}} = 1 \times 10^{-15}$
4.  $\text{AB}$   $K_{\text{sp}} = 1 \times 10^{-10}$

**Explanation:**

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**023 10.0 points**

The molar solubility of cerium(III) hydroxide ( $\text{Ce}(\text{OH})_3$ ) is  $5.2 \times 10^{-6}$  mol/L. What is the

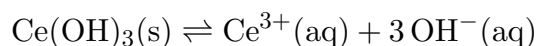
$K_{\text{sp}}$  of cerium(III) hydroxide?

1.  $4.935 \times 10^{-19}$
2.  $1.23375 \times 10^{-19}$
3.  $1.97414 \times 10^{-20}$  **correct**
4.  $9.8707 \times 10^{-19}$
5.  $2.4675 \times 10^{-19}$

**Explanation:**

$S$  = molar solubility

The reaction is



$$K_{\text{sp}} = [\text{Ce}^{3+}][\text{OH}^{-}]^3 = S (3S)^3$$

$$= 27 S^4 = 27 (5.2 \times 10^{-6})^4$$

$$= 1.97414 \times 10^{-20}$$

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**024 10.0 points**

Rank the following compounds from most soluble to least soluble. Assume that all bonds except the OH are ionic. (You can estimate this ranking without using a calculator.)

Compound	$K_{\text{sp}}$
$\text{Bi}_2\text{S}_3$	$1.0 \times 10^{-97}$
$\text{Fe}(\text{OH})_2$	$1.6 \times 10^{-14}$
$\text{PbI}_2$	$2.6 \times 10^{-13}$
$\text{HgS}$	$1.6 \times 10^{-52}$

1.  $\text{PbI}_2 > \text{Fe}(\text{OH})_2 > \text{HgS} > \text{Bi}_2\text{S}_3$
2.  $\text{HgS} > \text{PbI}_2 > \text{Fe}(\text{OH})_2 > \text{Bi}_2\text{S}_3$
3.  $\text{Bi}_2\text{S}_3 > \text{Fe}(\text{OH})_2 > \text{HgS} > \text{PbI}_2$
4.  $\text{PbI}_2 > \text{Fe}(\text{OH})_2 > \text{Bi}_2\text{S}_3 > \text{HgS}$  **correct**
5.  $\text{Fe}(\text{OH})_2 > \text{PbI}_2 > \text{HgS} > \text{Bi}_2\text{S}_3$

**Explanation:**

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**025 10.0 points**

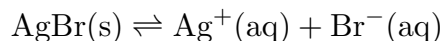
What is  $K_{\text{sp}}$  for AgBr, if its molar solubility is  $8.8 \times 10^{-7}$  mol/L?

1. 0.0053
2.  $1.69 \times 10^{-14}$
3.  $7.744 \times 10^{-13}$  **correct**
4.  $6.9 \times 10^{-9}$
5.  $1.4 \times 10^{-21}$
6.  $5.2 \times 10^{-19}$
7.  $8.281 \times 10^{-17}$

**Explanation:**

$$S = 8.8 \times 10^{-7} \text{ mol/L}$$

The solubility equilibrium is



$$[\text{Ag}^+] = [\text{Br}^-] = S = 8.8 \times 10^{-7} \text{ mol/L}$$

$$\begin{aligned} K_{\text{sp}} &= [\text{Ag}^+][\text{Br}^-] \\ &= (8.8 \times 10^{-7})^2 \\ &= 7.744 \times 10^{-13} \end{aligned}$$

5. None of the statements is true.

**Explanation:**

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**027 10.0 points**

The  $K_{\text{sp}}$  equation for sodium bicarbonate ( $\text{NaHCO}_3$ ) should be written as

1.  $K_{\text{sp}} = [\text{Na}^+][\text{H}^+][\text{CO}_3^{2-}]$ . **correct**
2.  $K_{\text{sp}} = [\text{Na}^+][\text{H}^+][\text{C}^{4+}][\text{O}^{2-}]^3$ .
3.  $K_{\text{sp}} = [\text{NaH}^{+2}][\text{CO}_3^{2-}]$ .
4.  $K_{\text{sp}} = [\text{Na}^+][\text{H}^+][\text{CO}_3^{-2}]^2$ .

**Explanation:**

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**026 10.0 points**

$K_{\text{sp}}$  for iron(III) iodate ( $\text{Fe}(\text{IO}_3)_3$ ) is  $1.0 \times 10^{-14}$ . We mix two solutions, one containing  $\text{Fe}^{3+}$  and one containing  $\text{IO}_3^-$ . At the instant of mixing,  $[\text{Fe}^{3+}] = 10^{-4}$  M and  $[\text{IO}_3^-] = 10^{-5}$  M. Which of the following statements is true?

1. No precipitate forms because  $Q_{\text{sp}}$  is less than  $K_{\text{sp}}$ . **correct**
2. No precipitate forms because  $Q_{\text{sp}}$  is greater than  $K_{\text{sp}}$ .
3. A precipitate forms because  $Q_{\text{sp}}$  is less than  $K_{\text{sp}}$ .
4. A precipitate forms because  $Q_{\text{sp}}$  is greater than  $K_{\text{sp}}$ .